

Problem 3.37: A Circuit Problem

You are given the depicted circuit (Figure 3.79).

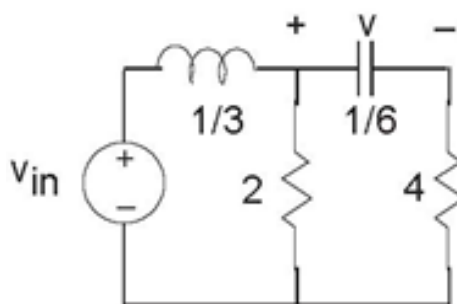


Figure 3.79 A Circuit Problem

1. Find the differential equation relating the output voltage to the source.
2. What is the impedance "seen" by the capacitor?

Problem 3.38: Analog Computers

Because the differential equations arising in circuits resemble those that describe mechanical motion, we can use circuit models to describe mechanical systems. An ELEC 241 student wants to understand the suspension system on his car. Without a suspension, the car's body moves in concert with the bumps in the road. A well-designed suspension system will smooth out bumpy roads, reducing the car's vertical motion. If the bumps are very gradual (think of a hill as a large but very gradual bump), the car's vertical motion should follow that of the road. The student wants to find a simple circuit that will model the car's motion. He is trying to decide between two circuit models (Figure 3.80).

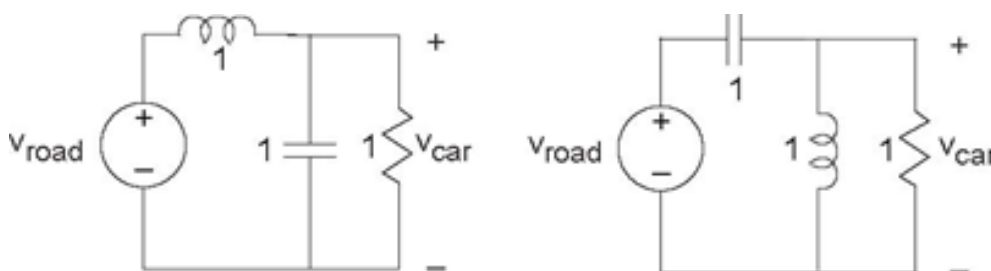


Figure 3.80 Analog Computers

Here, road and car displacements are represented by the voltages $V_{\text{road}}(t)$ and $V_{\text{car}}(t)$, respectively.

1. Which circuit would you pick? Why?
2. For the circuit you picked, what will be the amplitude of the car's motion if the road has a displacement given by $V_{\text{road}}(t) = 1 + \sin(2t)$?